SELECTION OF SUITABLE CENSUS METHOD FOR THE INDIAN SARUS CRANE *GRUS ANTIGONE ANTIGONE*[1]

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(*With one text-figure*)

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An estimation of the population size of the Indian sarus crane *Grus antigone antigone* was done in the summer of 1997 and 1998. A total of 432 and 457 cranes were counted, in the 526 sq. km area of Kheda district, Gujarat, during hot hours (1200-1600 hrs) in 1997 and 1998 respectively. Night roost count at reservoirs (548) was higher than the day roost count. Results suggested that for accurate population estimation, the night roost count is better, but time and man power requirements can be a limitation. For a large scale census, the day roost count at reservoirs and their environs could be better.

INTRODUCTION

Estimation of avian population is the basic requirement to initiate any study leading to their conservation. Qualitative statements regarding status and distribution do not give a true picture of the population size, irrespective of the species studied. To decide conservation management strategies, it is necessary to estimate the actual population size at a given site at the right time. With a drastic reduction in its distribution range and a total of 12,000 individuals worldwide (Gole 1989, 1991), the Indian sarus crane *Grus antigone antigone* is now considered as a globally threatened species (Meine and Archibald 1996). Despite several limitations in the census method, attempts have been made to estimate the sarus crane population in Gujarat State (Vaishnav 1985) and its distribution range in India (Gole 1989). In Kheda district, the sarus crane density on a fixed route had been attempted (Parasharya *et al.* 1996) along with population estimation. Here we have attempted to estimate the sarus crane population in Matar tehsil of Kheda district to supplement the above study during summer in two successive years.

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We attempted to determine the total population using two different methods. This paper describes the merits and demerits of both the methods selected for determining the sarus crane population and density.

MATERIAL AND METHODS

The census was done during the summer months April, May and June 1997 and May 1998. Cranes encountered along the road and in and around reservoirs were counted within the four hour period of 1200-1600 hours (hot hours) in one day. If an area was left uncovered during the stipulated time period, it was completed on the next day. The cranes concentrated chiefly around five major reservoirs. Hence, the maximum crane count around any of these reservoirs, in a particular month, was taken into consideration during the census of 1997. At the same time, care was taken to ensure that the crane population in the adjacent area was counted as a separate population. Cranes sighted within 800 m on either side of the road were also counted. The presence and growth stage of paddy crops around the census area were noted to understand the crane distribution pattern. During 1998, counts were done only on 24-25 May.

Night roost counts were attempted at 16 reservoirs from May 17-24, 1998. Unlike the

noon count, in which one person could count cranes on several reservoirs in a four hour period, it took one person to estimate the roosting cranes at a particular reservoir in one night. Thus, the three individuals involved could survey only three reservoirs in a single day. All the cranes present in the reservoir and the ones arriving were counted till it was totally dark. The sun set at 1912-1916 hours during the count period.

Study Area

The study was conducted in a 526.03 sq. km area spread over Matar, Khambhat and Petlad tehsil of Kheda district, Gujarat. Major reservoirs, at which the study was conducted, along with the main roads, are shown in Fig. 1. The study area has the benefit of well established branching canals terminating in reservoirs. The landscape is plain, low lying and suitable for paddy crop (*Oryza sativa*) cultivation during monsoon due to irrigation facilities. During the southwest monsoon (July to September), the whole area gets flooded and remains so till late September. In the summer (April to June), the reservoirs retain some water, at least at miniumum level. Depending on local conditions, paddy crop is grown in the command area of some reservoirs even in summer. The temperature reaches 45.6 °C, particularly in May.

Results

Population estimation during hot hours in summer: The sarus crane population in the study area (526.03 sq. km) in 1997 was 432, while in 1998 it was 457 (Table 1), and had a density of 0.82 /sq. km to 0.87 /sq. km cranes respectively. The difference in the numbers sighted between the two years was negligible. Moreover, this was the minimum population estimated, as only the actually seen cranes were counted.

Table 1
POPULATION ESTIMATION OF SARUS CRANE DURING NOON HOURS OF SUMMER MONTHS IN KHEDA DISTRICT, GUJARAT

Sites	No. of cranes observed 1997	1998
1. Bhanderaj (R)	76	79
Surrounding area	3	4
2. Narda (R)	135	0
Surrounding area	17	21
3. Gobrapura (R)	0	0
Surrounding area	40	138
4. Daloli (R)	65	105
Surrounding area	6	8
5. Traj (R)	44	0
Surrounding area	9	1
6. Pariej (R)	0	0
Surrounding area	2	6
7. Kanewal (R)	0	0
Surrounding area	23	15
8. Others (R)	12	80
Total	432	457

During both years, the crane number was highest in Narda-Gobrapura and its surrounding complex, proving it to be an important area (Table 1). Bhanderaj and Daloli also supported a high number of cranes. Though Kanewal and Pariej were the largest reservoirs, the number of cranes present here were insignificant, as both the reservoirs have a very great water depth and lack suitable roosting sites. They are also subject to continuous human interference, especially disturbance from fishing.

The cranes which concentrated at the Narda reservoir and its environs in 1997 shifted to Gobrapura in 1998. Similarly, the cranes at Traj and its environs shifted to Machhial. Both the shifts were within 5-6 km, and were probably due to changes in the water level of the reservoir and the paddy crops around it. The crane count, at the five reservoirs, was fairly high and constant during the study period.

All these reservoirs are situated within a range of 5-15 km from each other, but still hold a distinct population, suggesting that sarus cranes are highly sedentary and restricted in their activity around a particular reservoir.

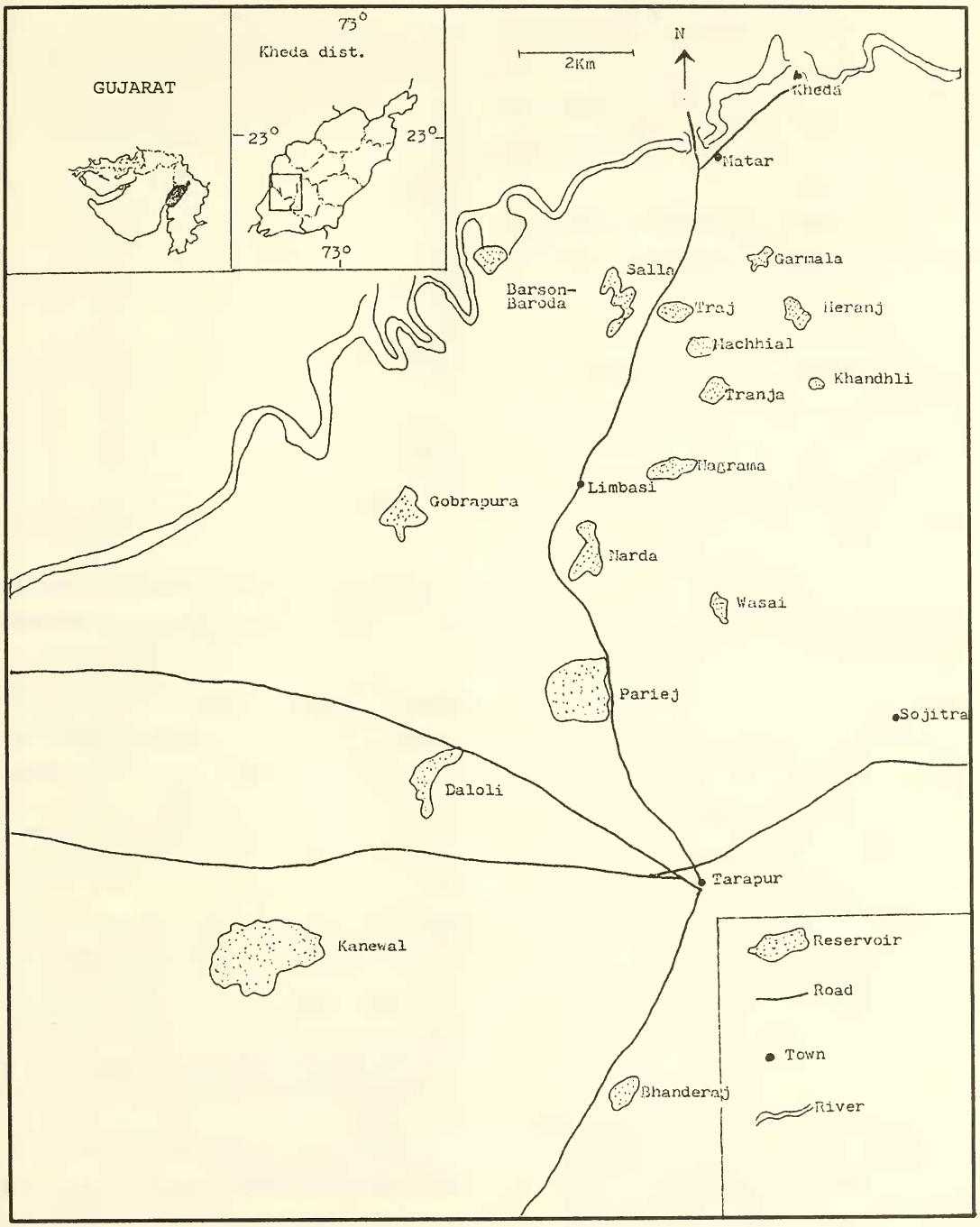

Fig. 1: Major reservoirs and roads in the study area

In the summer, due to heat and stress, the cranes concentrated around the reservoirs in large flocks, which aided the census. However, the paddy crops growing around the reservoirs also provided a suitable protected habitat from the heat, which was evident from the count in the surrounding area.

Population estimation during night roosting in summer: As it was a dry period, all the cranes converged to the reservoirs for roosting. Sixteen reservoirs spread over the study area were monitored to count the roosting sarus population, hence no flock was missed from the total estimate. A total of 548 sarus crane were counted, giving a density of 1.04 /sq. km during a night roost count.

About 65% of the cranes concentrated chiefly around 4 major reservoirs, the Daloli, Gobrapura, Narda and Machhial (Table 2). The area important for day roosting, was also found significant for night roosting. Another important site was Bhanderaj, which had 24% of the sarus cranes at night. 11% were distributed in 8 small reservoirs.

Three reservoirs, though they had sufficient water, were not used by the cranes. The sarus cranes numbers at a particular reservoir were determined by its water level and suitable, safe roosting sites. At Barson-Baroda the cranes roosted in the shallow waters of the river basin. It was the only site of the riverine area that we examined for the night roost. The number of cranes estimated during the night roost was 16% higher than the count during the day roost.

TABLE 2
POPULATION ESTIMATION OF ROOSTING SARUS CRANE, DURING SUMMER, IN KHEDA DISTRICT, GUJARAT

Site	Crane number
Bhanderaj	133
Narda	51
Gobrapura	60
Daloli	152
Traj	00
Pariej	02
Kanewal	04
Tranja	02
Salla	12
Naghrama	04
Heranj	00
Khandhli	00
Garmala	02
Machhial	92
Vasai	09
Barson-Baroda	25
Total	548

DISCUSSION

During summer, the water was available only in the reservoir or in the paddy crops growing around the reservoirs. To avoid heat stress, the cranes flocked in the reservoirs or in the paddy crop, enabling an almost accurate population estimation. To avoid the heat stress of summer, the sarus cranes are known to flock in the wetlands (Ramachandran and Vijayan 1994, Mukherjee *et al.* 1999, in press).

In summer, the cranes move far off for foraging during the morning and evening hours, but they returned to the reservoirs from 1200 hours onwards (Mukherjee *et al.* 1999). Once at the reservoir, the cranes did not show any movement for four hours and hence, the chances of count duplication were negligible. Four hours are sufficient to travel across the study area to estimate the population in the reservoir and along the route. Two persons with a vehicle needed two days to complete the count in the 526.03 sq. km area. Hence, sarus crane census during hot hours (1200-1600 hours) in the summer is ideal. Limited man power and time frame placed restrictions on the size of the area which could be surveyed.

The cranes utilised the summer paddy crops during the hot hours, both as foraging and roosting ground leading to a dispersed distribution, which subsequently caused underestimation of the population size. During

the summer of 1997, paddy was grown around most of the reservoirs making accurate counts difficult. However, in 1998, the cultivated area was limited, hence counting was easy.

In 1998, along with the day roost counts, night roost counts were made to overcome this drawback. For accurate population estimate, we made night roost counts in all the 16 reservoirs. The crane count during night roost was certainly higher than the day roost count. However, the one person to one reservoir ratio is time consuming and requires more man power. Our night roost counts could be accurate, as we were familiar with the study site and with the direction of the arriving cranes. Night roost counts can possibly be difficult in an unknown area, but in the present case, they were more accurate than the day roost count.

There was a difference of only 91 cranes in the counts by two methods. This indicates that the sarus is sedentary, does not show frequent movements and prefers the same area for day and night roosting. At least in the summer, cranes hardly dispersed 5-6 km from the reservoir. They also had an affinity for the water bodies for roosting. The same was seen around Bhanderaj, the only reservoir which ultimately attracted cranes from all over the area. Thus, the study highlighted the importance of these wetlands for the protection and conservation of the sarus crane.

It is worth noting that in the 526.03 sq. km of the study area, paddy was the only crop grown during monsoon. It was also grown in patches around reservoirs during summer. All the wetlands retained some level of water even in summer. However, only a few reservoirs were used by the cranes for roosting. Crane distribution was patchy, indicating that the presence of water in the reservoirs or in the paddy crop around reservoir are not the only factors responsible for the crane abundance / distribution. Gole (1989) had developed a formula to estimate crane population based on crane density derived through road transect and total wetland area separately. On the contrary, our study revealed that even though several wetlands existed, some were not utilised by cranes. Therefore, the earlier report by Gole (1989) may represent an inaccurate count. Recently, Mukherjee *et al.* (in press) had established a positive correlation between sarus crane abundance and percentage land under irrigated paddy crop, as well as visibility index / openness of the habitat. However, we found that in summer, factors like flocking, availability of paddy crop and time of the day influenced the crane numbers counted.

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